

The organization and financing of dialysis and kidney transplantation services in New Zealand

Toni Ashton¹, Mark Roger Marshall²

1. Health Economics, Centre for Health Services Research and Policy, School of Population Health, University of Auckland, Auckland, New Zealand

2. Department of Renal Medicine, Middlemore Hospital, Otahuhu, Auckland, New Zealand

Abstract

In New Zealand, patients receive treatment for end-stage renal disease (ESRD) within the tax-funded health system. All hospital and specialist outpatient services are free, while general practitioner consultations and pharmaceuticals prescribed outside of hospitals incur copayments. Total ESRD prevalence is 0.07%, half the U.S. rate, and the prevalence of home-based and self-care dialysis is the highest in the world. Medical staff are not subject to direct financial incentives that could affect treatment choice. Estimated total expenditure per ESRD patient is relatively low. Funding constraints encourage physicians and patients to consider the probable benefit of dialysis for a patient before treatment is prescribed.



This paper is part of the International Study of Health Care Organization and Financing, which examines how the treatment of renal failure is paid for around the world. This study comprises 13 related papers published in a two-part special issue of the *International Journal of Health Care Finance and Economics*. The original published version of this paper (© Springer Science+ Business Media, LLC 2007) is available at www.springerlink.com.

The ISHCOF is a substudy of the Dialysis Outcomes and Practice Patterns Study (DOPPS). The ISHCOF is supported by the Arbor Research Collaborative for Health; the DOPPS is supported by research grants from Amgen and Kirin Pharma without restrictions on publications. Arbor Research thanks Springer for permission to reproduce this article.

Reference: Ashton T, Marshall MR. The organization and financing of dialysis and kidney transplantation services in New Zealand. *Int J Health Care Finance Econ*: E-published ahead of print, 19 July 2007. DOI: 10.1007/s10754-007-9023-x.

Introduction

In New Zealand, citizens or permanent residents of New Zealand (and its dependencies Niue, the Cook Islands, and Tokelau) receive treatment for end-stage renal disease (ESRD) within the tax-funded public health system in the same way as patients with other medical needs. Tax funds are allocated to 21 District Health Boards (DHBs) by the government on a weighted capitation basis for the population living in their district. The DHBs then use these funds to either purchase services from private providers or directly provide services for the population residing within their geographically defined area. Services directly provided by the DHBs are free of charge. They include all secondary and tertiary hospital services, as well as a range of community-based services, including home-based hemodialysis. Any pharmaceuticals prescribed and directly dispensed from a hospital pharmacy to inpatients or outpatients in a hospital setting are also fully subsidized by the government. These conditions apply to all patients, including ESRD patients.

In contrast, primary health care is only partially subsidized by the government. Therefore patients must pay copayments in the range of NZ\$0–\$50 (US\$0–33; PPP 2004) for services provided by general practitioners (GPs). Copayments also apply to all pharmaceuticals dispensed by community pharmacies, regardless of whether they are prescribed in a hospital outpatient setting or by a GP, and regardless of whether or not the treatment is related to kidney disease. However, laboratory tests are provided under the public health system free of charge. The supply of primary health services is almost wholly private, and is mostly provided by group practices.

The primary health care system is currently undergoing a number of changes. First, GPs and other primary health care providers are grouping together into Primary Health Organizations, which contract with District Health Boards to provide a comprehensive set of primary health services to their enrolled populations. Second, the level of subsidies for GP consultations and pharmaceuticals is being raised gradually over a period of about five years (Ministry of Health, 2004a). The level of copayments for these services should therefore gradually decline. Third, the method of subsidizing patients is being changed to a universal payment system from a targeted system in which particular patient groups (including children, low-income families, and those with extensive health care needs) received higher levels of subsidy. Finally, the method of paying the government subsidy to GPs is being changed from fee-for-service to capitation payments. All of these changes are being rolled out over a number of years. This means that the incentives facing both patients and providers at the primary care level are mixed, depending upon the level and type of subsidy that is being paid to each provider, and the level of copayments charged to patients.

Methods

The International Study of Health Care Organization and Financing (ISHCOF) is a substudy of the Dialysis Outcomes and Practice Patterns Study (DOPPS) aiming to characterize economic structures and their impact on the delivery of dialysis care. The ISHCOF is based primarily on one-time commissioned surveys (2004–2005) and subsequent papers by authors from each of the 12 DOPPS countries. Details of the methods are described in Dor, Pauly, Eichleay, & Held (2007).

In general, the reported statistics and data in this article are based on secondary data sources including the Australia and New Zealand Dialysis and Transplant Registry (ANZDATA), the New Zealand Ministry of Health, and published articles. All monetary estimates were provided in national currency units (NZ\$) and converted to US dollars with OECD purchasing power parities (PPP) (OECD, 2006). Due to the small number of economic investigators and countries in this study, all international comparisons reported here are informal and qualitative, unless otherwise noted.

The gross epidemiology of kidney disease

New Zealand has a population of approximately 4 million, about 75% of whom are of European descent. The indigenous Māori people and their descendants make up about 14% of the population, while Pacific Island Polynesians are the third largest ethnic group (5%). Māori and Pacific Island people are generally younger and poorer than the rest of the population. Both of these ethnic groups are especially susceptible to diabetes and its sequelae, including ESRD.

As of 31 March 2004, there were 2845 cases of ESRD reported in New Zealand (ANZDATA, 2004). This represents a total prevalence rate of about 0.07%, half the rate of the United States (USRDS, 2004). Of the total, 1146 (40.3%) were patients with functioning transplants while the rest (1699) were receiving dialysis treatment. Total ESRD prevalence increased by 27% in the years 1998–2002, while dialysis prevalence increased by 36% (ANZDATA, 2003).

Before 2002, the number of new patients entering ESRD programs had been increasing steadily each year, reaching a zenith of 469 new patients in 2001. Between 1998 and 2001, the incidence rate increased by 25%. However, in 2002, the number of new patients declined for the first time since 1993, numbering 463 at year-end, a decrease of 1.3% from the previous year. In 2003, the incidence of ESRD continued to decline, with only 449 new patients and an incidence rate of 118 per million population (pmp). Together with a high number of new patients in the 1999 base year, this decline effectively brought the five-year (1999 – 2003) trend in incidence rate down to 14%. (ANZDATA, 2004).

The cause for this trend toward decreasing ESRD incidence is a matter for speculation. There have been no obvious changes in practice patterns among New Zealand nephrologists to provide a possible explanation. (In fact, it is generally acknowledged that dialysis is increasingly being offered by default to patients who are expected to have only marginal quality of life or longevity benefits. This point is discussed in more detail below.) A possible explanation for the recent decline in ESRD incidence is that it reflects a transient stalling in overall national growth of the treated ESRD population, due to the stepwise manner in which individual regions across New Zealand are progressively providing a full range of dialysis options. Historically, dialysis has most often been provided in New Zealand as a home-based or self-care therapy, limiting the access to dialysis by less capable or more medically unstable patients who are treated palliatively for ESRD without dialysis. In the last five to 10 years, provision of a complete range of dialysis options (home-based/ self-care, and hospital-based/dependent) in certain parts of New Zealand (Auckland, Manukau, Wellington, Northland province) has led to growth in regional prevalence

levels that are now more or less reaching a steady state. However, it is only now, in 2007, that other regions have begun to expand dialysis access by offering such a complete range of treatment options.

Research has demonstrated that minor variations in acceptance rates (the rate that patients commence treatment) across regions are not explained by medical comorbidity but are likely determined by differences in allocation and availability of treatment facilities and access to renal replacement therapy resources (Collins, 1998; Collins & Metcalf, 2003). In particular, the availability of dialysis services remains limited in certain areas (East Cape, Bay of Plenty, Palmerston North) that are informally recognized as having a large burden of untreated ESRD. In these areas, access to dialysis continues to be limited to the minority of patients who are capable of home-based or self-care dialysis. Funding agencies and dialysis providers in such regions are now grappling with the requirements for service expansion and necessary infrastructure, and several regional planning projects are underway. When the range of dialysis services is expanded in these areas, it is likely that dialysis will be offered to more patients in a form that is more likely to be accepted by growing demographic groups, such as the frail elderly. The resulting increase in reported ESRD incidence is then likely to be reflected in national figures.

The age- and sex-standardized incidence of ESRD among adult Māori and Pacific Islanders is two to ten times higher than the rates seen among non-indigenous New Zealanders and Australians (Stewart, McCredie, & McDonald, 2004). This discrepancy is associated with an incidence rate of diabetes (and obesity) that is more than three times higher among these ethnic groups than among people of European descent (Ministry of Health, 2002). A study of the characteristics of patients being treated for ESRD showed that 73% of Māori patients and 65% of Pacific Islander patients had diabetes, compared with only 21% of people of European origin (Collins & Metcalf, 2003). The median age of Māori patients at ESRD entry is younger than that for all patients (44 years versus 58 years) and their mortality rates across all modalities of treatment are higher than non-indigenous rates (McDonald & Russ, 2003).

There is a relatively low prevalence of kidney transplants in New Zealand due primarily to a very low donor rate of around 10 per million, compared with 22.3 per million in the US (Organ Donation New Zealand, 2005). The transplant rate has remained constant at approximately 28 per million from 1998 to 2003. The total number of kidney transplants performed has been in the range of 106 – 117 per year during this period (ANZDATA, 2004). There is no obvious explanation why the donor rate is so low in New Zealand. People who wish to donate their organs after death may register their wishes on their driving license. However, regardless of the expressed wishes of the deceased, an organ will only be retrieved if the donor's family has no objections. While the number of deceased donor organs has remained stable, the number of organs donated by live donors has been increasing steadily. In 2003, live donors accounted for 40% of all transplants compared with only 29% in 1998 (ANZDATA, 2004). The proportion of transplants from living donors is higher for patients of Pacific Island origin (around 50%) than for Māori or non-indigenous people. However, transplantation with deceased donor organs is very low among both Pacific Island people and Māori: of 204 deceased donors between 1996 and 2000, only 3.5% were Māori and 1% were Pacific Island people (Roake, 2002). Reasons for these low levels are not entirely clear but may include a cultural respect by these ethnic groups for the retention of organs.

In an effort to improve the overall donor rate, the government announced in January 2005 that living kidney donors (and also people who donate part of their liver) will be eligible for compensation towards loss of income. The level of payment is equivalent to the social security benefit for sickness (currently around NZ\$165 per week) for up to 12 weeks. The government is also considering other options for improving the kidney donor rate, including setting up a national organ donor registry.

The provision of care in New Zealand

The organization of treatment facilities in New Zealand is unusual in that, until very recently, all freestanding and hospital-based facilities were urban and owned publicly, by the DHBs. The relatively small number of people requiring dialysis, together with constrained public funding, has effectively precluded the development of competing private facilities. One small hospital-based private dialysis unit, which provides services only for paying patients, opened in October 2004. Almost all of these patients are non-residents. To date no citizen or permanent resident of New Zealand or its dependencies has received long-term maintenance dialysis entirely within the private sector.

In the public sector, there is an almost equal number of freestanding outpatient facilities and hospital-based facilities for dialysis (eight freestanding and nine hospital-based). However, the freestanding facilities provide care for more than twice as many patients per facility. This difference reflects a policy of treating as many patients as possible outside hospital-based facilities. New Zealand's small population means that there are only three transplantation units in the country, located in three of the major cities. All of these surgical units are owned and operated by the publicly-owned DHBs.

The number of physicians currently available to treat ESRD is probably sufficient. In a headcount conducted at the end of March 2004, New Zealand had 26 adult nephrologists and 2 pediatric nephrologists vocationally registered with the Royal Australasian College of Physicians. Although the number of whole-time equivalents was unknown, there was no more than one specialized nephrologist per approximately 102 patients with ESRD. This figure is probably within the range seen among other developed nations. At one end of this range is the United States, where, in January 2001, there were 5774 Board Certified nephrology WTEs (Renal Physicians Association), with a ratio of one specialized nephrologist per 66 patients with ESRD (USRDS, 2002). At the other end of this range is England, where as of 21 December 2002, there were 188.4 vocationally registered nephrology WTEs, with a ratio of one specialized WTE nephrologist to 162 patients with ESRD (UK Renal Registry, 2003). New Zealand limits the total number of physicians trained within the country, but it does not limit the number of nephrologists. Historically, there have not been enough locally trained nephrologists to supply the New Zealand nephrology workforce requirements. As a result, nephrologists receive an immigration priority through the Long Term Skill Shortage List provision of the New Zealand Immigration Service, alone out of all internal medicine specialists (New Zealand Immigration Service, 2003). The deficit in New Zealand's workforce requirements has consequently been

filled by the steady inflow of migrant specialists, although their ability to practice within New Zealand is contingent on local examinations and registration processes.

All surgeons who perform transplants in New Zealand also perform other procedures. As noted above, the prevalence of transplants among ESRD patients is low in New Zealand. In addition, due to New Zealand's small population size, the total number of transplants performed each year is also very low (just over 100 per year). Few surgeons now train in this area and the subspecialties that previously received transplant training (i.e., urology and vascular surgery) no longer do so. The supply of transplant surgeons is therefore now becoming tight. If the number of patients receiving transplants were higher, it is likely that the shortage of surgeons would become more acute.

Like many other Western countries, New Zealand is currently experiencing a serious shortage of nurses (Health Workforce Advisory Committee, 2002). This shortage has been attributed to rates of pay that do not reflect the level of skill and length of training that is now required by nurses, high stress, inflexible rosters, and limited opportunities for advancement. New Zealand nurses are also prey to international recruitment efforts from countries such as England, South Africa, and the United States. Satellite dialysis units are therefore often staffed by clinical dialysis technicians rather than nurses. There is also a shortage of these technicians, in part because there is no formal training available in New Zealand; most are recruited from India, Singapore, and South Africa, where there are recognized training programs and a transparent accreditation process. Potential recruits from those countries regularly approach hospital managers in New Zealand for employment, and are generally motivated to immigrate by better working conditions and the perception of New Zealand as a safe, family-friendly, and socially just environment with greater range of options for advancement of lifestyle.

Although New Zealand's rate of nephrologists may be comparable to that of other countries in the ISHCOF study, these specialists earn a median salary of NZ\$150,000 (US\$100,600; PPP 2004), which is among the lowest in ISHCOF countries (personal communication, D. Keys, January 2005). Average wages for many occupations are generally lower in New Zealand. In addition, unlike many other medical specialties in New Zealand, nephrologists have only limited opportunity to augment their salaries by working part-time in private practice, since the scope of private practice for nephrologists does not routinely include private dialysis except for the vacationing overseas dialysis patient market. Since nephrology services— particularly dialysis — are provided by the public rather than the private sector, salaries are set by the government rather than by the market. There would be a shortage of nephrologists in New Zealand if not for immigrant nephrologists from South Africa, the United Kingdom, and Asia who chose to live and work in New Zealand for generally the same sorts of reasons as those pertaining to the dialysis technicians discussed above. Dialysis nurses, at a median salary of NZ\$42,000 (US\$28,000; PPP 2004) per year, earn wages similar to those seen for nurses in other countries (personal communication, D. Keys, January 2005).

Rationing of treatment services

Dialysis has always been rationed in New Zealand; at no point in the national history of dialysis have resources have been universally available. In the past, patients have been rejected because

of older age or the presence of diabetes mellitus, criteria with limited predictive accuracy for early death or poor quality of life. In the mid 1990s in New Zealand, criteria from funding agencies to restrict access to dialysis for purely fiscal reasons resulted in a widely publicized death of a patient with ESRD who likely would have benefited from dialysis sufficiently to justify treatment. At that time, however, the criteria pertaining to this patient restricted dialysis to those with an expected longevity of more than two years on dialysis, among other characteristics. These criteria were subsequently criticized by both the New Zealand Human Rights Commission and the Race Relations Conciliator, and they were abandoned in clinical practice (Coney, 1994). Growth patterns in New Zealand reflect global acceptance policies for new patients that have become more liberal (McDonald & Russ, 2002), particularly for the older population, who have lower age-matched risk and who may be more satisfied with a lifestyle on dialysis than younger patients (Kjellstrand, 1996). The exception to this generalization lies with the treatment of Polynesians with non-residency status in terms of New Zealand and its dependencies. In the late 1990s, non-resident Polynesians with ESRD were offered dialysis and the costs of their treatment were absorbed. However, in the last two to three years such patients have generally been refused residency status and deported if necessary. Such patients may number perhaps 10–15 per year nationally. Historically, constraints on public funding have also led to waiting lists for dialysis (as well as for other procedures). More recently, there has been increasing public scrutiny of individual cases where medical decision-making has not conformed to public expectations. For the issue of dialysis, this was recently highlighted by a well-publicized legal action in New Zealand on behalf of a patient who was not offered dialysis — despite determined requests from the family — because of medical comorbidity. Although courts upheld the right of clinicians to make such a decision (New Zealand Court of Appeal, 1997), such incidents have changed public expectations and have led to more objective and transparent processes of patient assessment, as well as greater efforts to incorporate patients' preferences into their medical care.

Although there are presently fewer constraints on public funding for dialysis than previously, and dialysis is generally started without delay when clinically appropriate, such constraints do manifest themselves in other ways. New Zealand has the highest prevalence of home-based and self-care dialysis in the world (USRDS, 2004). This practice pattern and dialysis infrastructure has evolved in part from a philosophical position among New Zealand nephrologists that this form of dialysis is better (Lynn & Buttimore, 2005). This paradigm arises from a number of factors, including a general awareness among nephrologists of observational data that suggest equivalent outcomes for, firstly, peritoneal dialysis versus hemodialysis (Jager et al., 2001; Lamping et al., 2000; Vonesh & Moran, 1999), and secondly, generally better outcomes for home-based versus satellite- or hospital-based hemodialysis (Saner, Nitsch, Descoedres, Frey, & Uehlinger, 2005; Mowatt, Vale, & Macleod, 2004; Wood, Port, Stannard, Blagg, & Held, 1996). In addition to reports of improved longevity and health, there is consistent accumulated clinical experience within New Zealand nephrologists of higher quality of life with home-based therapies, an impression which is borne out to some degree by published literature (Oberley & Schattell, 1996; Bremer, McCauley, Wrona, & Johnson, 1989). Notwithstanding the perceived clinical benefits of home-based therapy programs, such programs have also been perpetuated by the need to minimize costs; there is generally considerable resistance at the DHB level to developing large hospital-based or freestanding units.

The reduced access to dialysis in parts of New Zealand that are only served by home-based and self-care dialysis can therefore be regarded as contributing to overall rationing and budget management.

There are also waiting lists for transplantation. In an attempt to ensure equity of access to transplantation and other services, clinicians are required to follow a set of common protocols when determining which patients on waiting lists will be given priority (Ministry of Health, a, b).

Expenditures and payments

New Zealand's total health expenditure in 2002 was NZ\$10.7 billion (US\$7.3 billion; PPP 2002), or 8.5 percent of its GDP (Ministry of Health, 2005), yielding one of the lowest total health expenditures per capita (US\$1850; PPP 2002) among ISHCOF countries (Dor, Pauly, Eichleay, & Held, 2007). Despite this relatively low health expenditure, real public and private health care expenditures increased by 31% and 27%, respectively, between 1998 and 2002. Public funds account for the large majority (77.9%) of total health expenditure, with legally mandated insurance paid for by general taxation covering the entire population. The total costs of ESRD in New Zealand are not reported separately from other expenditures within the public health system. However, totaling the estimated cost of individual items of expenditure on ESRD suggests that total expenditure on ESRD is about 0.91% of total health expenditure. On a per ESRD patient basis, the total expenditure in New Zealand in 2003 was NZ\$34,123 (US\$23,372; PPP 2003)(see appendix for estimation methods). About one-third of the New Zealand population has private insurance. However, private health insurance is generally not comprehensive and accounts for less than 6% of total health expenditure (Ministry of Health, 2005). ESRD treatment is excluded from the policies of all but one private insurance provider, these treatments being fully funded for all of the population through the tax-funded public health insurance. Insurance companies have expressed little interest in the area of dialysis despite considerable pressure from nephrologists with aspirations to expand their private practices. This may be a form of risk-avoidance on the part of insurance companies. On the other hand, it may be that public provision of dialysis is generally not so inferior as to create a compelling demand for systematic funding and provision of dialysis services by the private sector.

While all inpatient and outpatient secondary services are free, GPs are entitled to extra-bill for their services over and above any subsidy to which their patients are entitled. Any patients with private insurance (including ESRD patients) can claim these copayments back from their insurance company. People with ESRD may be eligible for tax-funded unemployment, sickness or invalid benefits if they are unable to maintain employment. All of these social welfare benefits are income-tested. Low-income patients are also entitled to free transportation to their dialysis appointments.

Hospital payments and costs

The global budget provided by the Ministry of Health to DHBs is based on a weighted capitation formula that determines the share of public funding allocated to each board (Ministry of Health, 2003). The formula is based on the demographic and socioeconomic makeup of the population

residing in a DHB's region, in addition to other factors thought to affect the relative cost of providing services. Each DHB then uses these funds to either provide services directly or contract from the private sector. In practice, most secondary and tertiary services are provided directly by DHBs, while most primary health care and other community-based services are provided by the private sector.

Services provided within DHB-owned public hospitals and satellite facilities are also effectively funded by a global budget, with service budgets based upon estimated volumes of cost-weighted diagnosis related groups (DRGs). National Contract Prices for DRGs do not always reflect the actual cost of service provision, though hospitals do have some flexibility to reallocate resources as required, depending on their particular cost structures and demand for different services. Nevertheless, there is still a limit to the amount of money available for all types of treatments, including the treatment of ESRD, during a specific period. While the budget constraint is intended to be binding, public hospitals do sometimes go into deficit. Even so, there is tight control over public hospital expenditure, which provides a strong incentive to keep treatment costs down.

Calculating accurate hospital costs is difficult in New Zealand: different hospitals have different cost structures and these costs are not available publicly. However, a broad estimate can be made based upon personal communication with district health board personnel. In 2003 there were 747 admissions for ESRD patients at an estimated total cost of NZ\$7.4 million (US\$5.1 million; PPP 2003). In addition, because outpatient dialysis treatment is provided by public hospitals, outpatient costs in New Zealand are regarded as part of hospital costs. The average cost of an outpatient hemodialysis treatment is about NZ\$212 (US\$142; PPP 2004) per session.

The Auckland Regional Renal Report (unpublished) estimated the total costs for dialysis care provided in one major DHB from 2002–2004. These costs included routine dialysis treatments, hospitalizations, physician visits not related to dialysis, and transportation. Hospital hemodialysis treatment was the most expensive at NZ\$ 64,318 (US\$44,053; PPP 2003), followed by satellite HD at NZ\$48,172 (US\$32,995; PPP 2003), Continuous Automated Peritoneal Dialysis (CAPD) at NZ\$36,615 (US\$25,078; PPP 2003), and home HD at NZ\$33,584 (US\$23,003; PPP 2003). Recent (unpublished and confidential) data from another DHB providing ESRD care in New Zealand show similar estimates.

The cost of a kidney transplant operation is estimated at NZ\$44,143 (US\$30,235; PPP 2003) and the cost for the year following the operation is NZ\$21,838 (US\$14,958; PPP 2003) (Auckland Regional Renal Report — unpublished), suggesting a total cost of NZ\$65,981 (US\$45,192; PPP 2003). However, the price that the government currently pays for transplants is significantly lower — around NZ\$20,000 (US\$13,400; PPP 2004). This large discrepancy obviously has real implications for transplant services. It seriously constrains the application of new technologies (e.g., ABO-incompatible transplants and transplantation of highly sensitized patients) because doing so would increase the losses. It also creates regional inequities because the three District Health Boards that provide transplant services are effectively subsidizing the other DHBs whose patients they also treat.

Provider payments

All clinical personnel who are employed in public hospitals, including nephrologists, surgeons, nurses, and technicians, receive 100% of their payment in salary. Most general practitioners receive income in the form of either capitation payments or fee-for-service, although a few are salaried. The mix of payment for general practitioners varies significantly depending upon the type of organization and mix of patients.

Specific aspects of treatment and financing

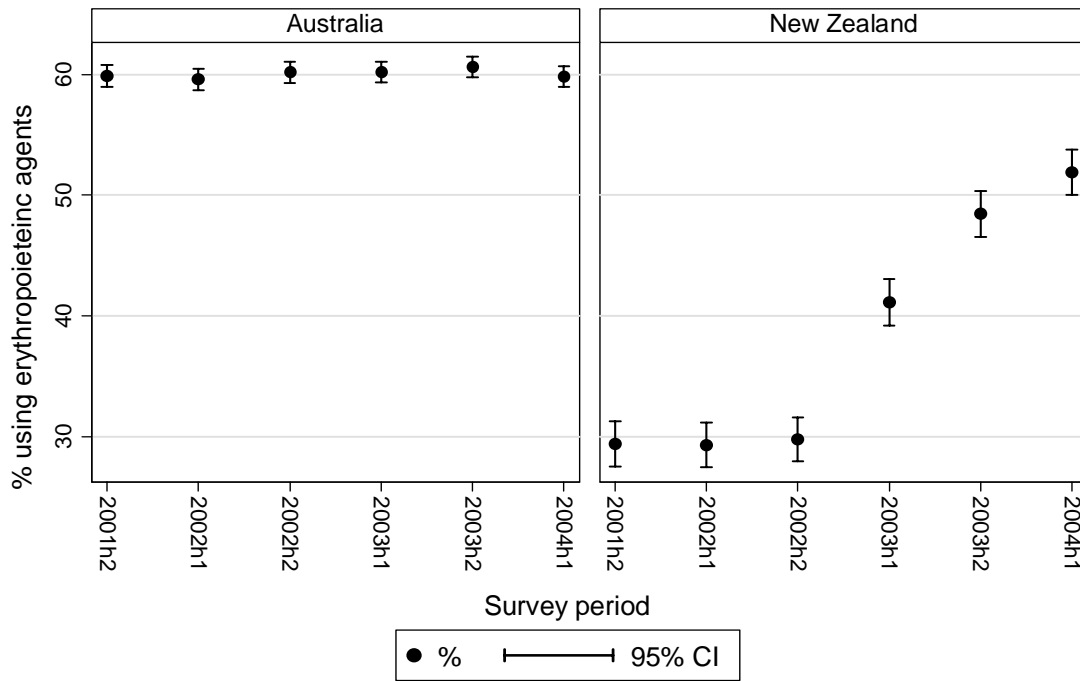
Prescription drugs

The public health care system covers all prescription drugs for ESRD, including erythropoietin (EPO). The listing and pricing of pharmaceuticals is tightly controlled in New Zealand by a central government agency, the Pharmaceutical Management Agency (Pharmac). Once a product has received approval from the Ministry of Health, all pharmaceutical companies must apply to Pharmac if they wish to have their product listed on the pharmaceutical schedule and thus be eligible for public subsidy. Pharmac assesses each application with a set of criteria that include the availability of substitute products, the drug's relative benefits and risks, and cost-effectiveness.

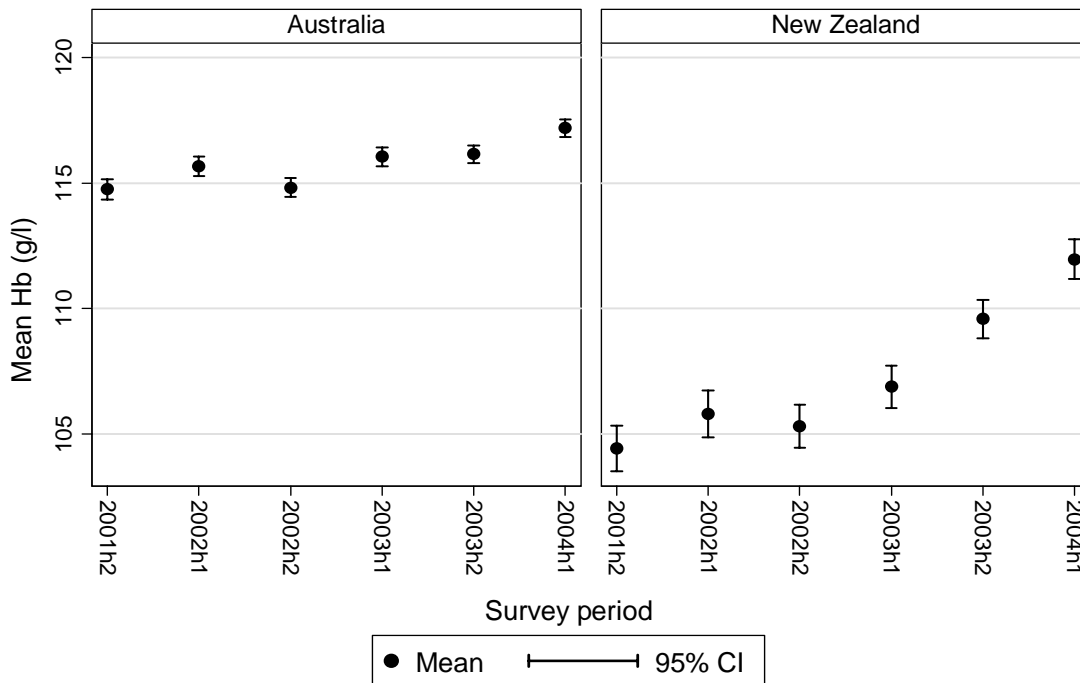
Pharmac negotiates subsidy levels with suppliers and sets prescribing guidelines and conditions. A system of reference pricing is used, in which all drugs within a therapeutic category are reimbursed for the price of the least expensive drug in that category. Being a monopsony purchaser, Pharmac has been very successful in negotiating deals for pharmaceuticals at prices that are often well below the prices paid in other countries, especially the United States. This situation has resulted in average increases in government expenditure on pharmaceuticals of less than 2% per year over the past five years (Pharmac, 2004). At the same time, this tight central control means that some drugs readily available in other countries are sometimes not publicly funded in New Zealand, or are subject to tight limitations on their use. As a result, the choice of drugs is often limited, and access may be compromised.

Until recently, EPO was publicly funded only for patients who had been on dialysis for more than three months, had a hemoglobin level lower than 70 g/L in the absence of heart disease, or had a hemoglobin level lower than 90 g/L in the presence of limiting angina or severe echocardiographically proven left ventricular impairment. Anecdotally, this restriction was recognized as leaving many patients with low quality of life and often resulted in increased utilization of blood transfusions. In addition, observational analyses have strongly suggested that this practice in general is associated with increased mortality risk, as reflected in the consensus KDOQI (NKF, 2001) and European Best Practice Guidelines (Barany et al., 1999) Guidelines, both of which recommend a hemoglobin level of >110 g/L. In 2003, Pharmac widened its access criteria to include any patient with anemia associated with chronic kidney disease as defined by a hemoglobin level lower than 100 g/L and a glomerular filtration rate <35mL/min (or <45mL/min in the presence of diabetes mellitus). As a result, both access to EPO and hemoglobin levels have risen quite dramatically, as illustrated in Fig. 1.

Figure 1 (a) Use of erythropoietic agents, by survey and country; (b) Mean hemoglobin among dialysis patients, by survey and country.



Reported use of erythropoietic agents, all dialysis patients, by country



Reported Hb, all dialysis patients, by country

Source: ANZDATA Registry 2004 Report, Ch. 4, p 32

There are still limits, mainly imposed by Pharmac, on the prescription and dispensing of iron, vitamin D in the form of calcitriol, and phosphate binders. With regard to iron, there is no subsidized oral formulation, and tablets must be purchased at full cost from community pharmacies by the patient. Moreover, the only subsidized intravenous iron is iron polymaltose, and other formulations (e.g., in the case of an allergy) must be purchased directly from pharmaceutical companies by the DHBs, which in most cases absorb the cost at a service level. With regard to calcitriol, there is no subsidized intravenous formulation, and oral capsules can only be prescribed by nephrologists to be obtained through hospital or community pharmacies. With regard to phosphate binders, the only subsidized calcium salt for this purpose is calcium carbonate, which is less effective than the acetate or citrate salts. Moreover, arguably the most desirable and safest phosphate binder in the world, sevelamer hydrochloride, is wholly unavailable, mainly as a result of its local distribution rights being held by a Japanese pharmaceutical company whose priorities do not include the marketing of sevelamer in New Zealand. This situation highlights a deficiency in Pharmac with regard to so-called “orphan” pharmaceuticals. While patients or DHBs may buy such pharmaceuticals directly from pharmaceutical companies, this rarely occurs, as there is no provision for the public subsidy of such products in the absence of a sponsoring pharmaceutical company. A direct clinical corollary of the situation with phosphate binders is that potentially toxic aluminum-based products are still widely utilized in New Zealand, although they are increasingly redundant in other western nations where the full range of arguably superior phosphate binders is available.

As noted above, all pharmaceuticals supplied directly from the hospital pharmacy to inpatient or outpatient hospital patients, including EPO and intravenous iron, are provided free of charge. However, there are usually copayments for pharmaceuticals prescribed by primary care physicians or in the hospital outpatient setting and dispensed by community pharmacies up to a maximum of NZ\$15. Copayments are lower for some population sub-groups including children, people with low incomes, and those with predictably high health care needs.

In summary, prescription drug use in New Zealand is subject to tight central control, with the listing of drugs on the national formulary, the price paid to suppliers, and any restrictions on use all set centrally by Pharmac. This system effectively ensures that public funds are used where the benefits are likely to be greatest and keeps prices and expenditures down. However, this system also sometimes restricts New Zealanders' access to drugs. Copayments for prescription drugs supplied by community pharmacies may act as another barrier to access.

Hospitalization

Hospital stays in New Zealand are relatively short for both ESRD treatment (3.31 days in 2003–04) and transplants (6.81 days) (New Zealand Health Information Service, Personal Communication, March 2006). For organ donors, the average length of stay is 2 days. The total expenditure for these stays is not known, but it is covered entirely by public funds within the global public hospital budgets. This, together with the fact that hospital physicians are salaried, means that there is no direct payment either to the hospital or to the physician for any of the services provided on an inpatient or outpatient basis.

Capped funding inevitably means that services must be rationed in some way. However, there are no age cut-offs, no limits to the number of treatments, and no rigid criteria. Instead, access to life-sustaining treatments such as dialysis is generally determined by both service managers and clinicians on a case-by-case basis balancing clinical need and available resources, as discussed above.

Transplantation

Kidney transplantation is performed in only three of the major public hospitals in New Zealand. In 2003, there were 111 transplant operations, and 85% of the recipients received a kidney for the first time (ANZDATA, 2004).

Transplantation candidates face waiting lists due to a shortage of organs. Approximately 300 New Zealanders are currently on the kidney transplant waiting list; most can expect to wait 2 or 3 years, unless they are able to find a living donor sooner (Roake, 2002). To be eligible for the transplant waiting list, patients are generally required to have a greater than 80% chance of two-year survival from all causes of mortality. Other waiting list criteria incorporate the extent and impact of comorbidities such as cancer and cardiovascular disease (Ministry of Health, b).

The incidence of kidney transplantation is affected by demographic and racial differences. In 2003, 46.8% of transplant recipients were aged between 35 and 54 years, the median age of recipients being 41.2, compared to 42.1 years in 2001 (ANZDATA 2004). The age of recipients ranged from 5.9 to 68.3 years. For patients receiving dialysis, the probability of being accepted on to the renal transplantation waiting list is significantly lower for Māori and Pacific Islanders (34% and 33%, respectively) than for non-indigenous groups (59%) (McDonald & Russ, 2003; Roake, 2002). Once accepted on to the list, the probability of Māori and Pacific Island patients receiving a transplant is also lower. In 2002, only 2.9% of Māori and 6.2% Pacific Island dialysis patients received a kidney transplant, compared with 13.9% of Caucasian patients. Reasons for these differences may include a lower donor rate and higher rate of comorbidities among these groups. However, McDonald & Russ (2003) found that not all of this difference could be explained by ethnic differences in comorbidities, age, and sex.

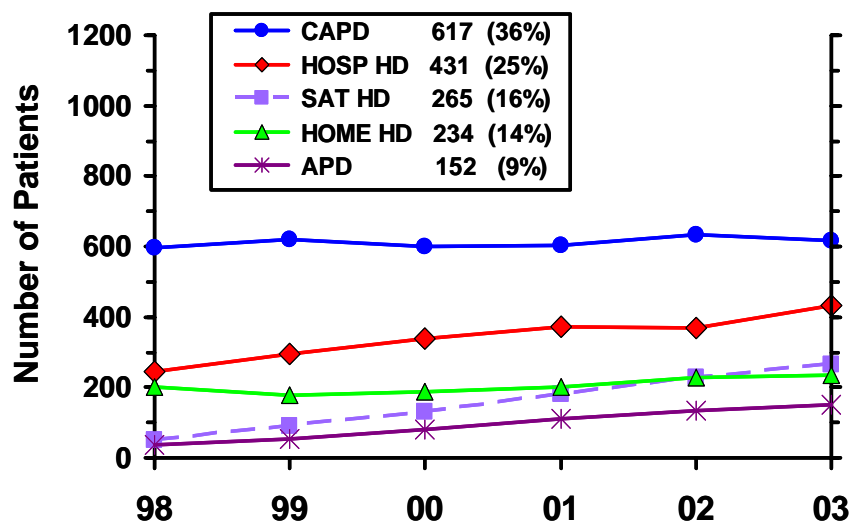
Organ retrieval is the responsibility of a single national office, the National Transplant Donor Coordination Office, which works in close collaboration with transplant units in both New Zealand and Australia. The donor coordinator organizes all aspects of the organ retrieval operation, including blood testing of the donor, liaising with the operating rooms, and arranging all the transport for the transplant teams to travel to the donor hospital (Organ Donation New Zealand, 2005). The allocation of organs is determined by a national organ allocation system with a primary focus on tissue matching.

Dialysis

In New Zealand, 45% of ESRD patients are treated with peritoneal dialysis (PD) (Fig. 2); this is the largest percentage of PD patients among ISHCOF countries (Dor, Pauly, Eichleay, & Held 2007). Forty-one percent of patients are treated at hemodialysis units and 14% are treated with home hemodialysis (ANZDATA, 2004). Most patients (59%) receive either home HD or PD,

reflecting both the philosophical stance of nephrologists historically, and the fact that these options are less costly for a DHB to provide than facility-based care. For individual patients, the choice between home and facility dialysis is influenced by quality of life, clinical characteristics, ability to train patients for self-care, the level of family support, and what dialysis options are available where they live (Nicholls B, 2001, Unpublished).

Figure 2. Method and Location of Dialysis 1998–2003.



Source: Australia and New Zealand Dialysis and Transplant Registry (2004) 27th Annual Report, p. 28.

At present, there are no waiting lists for anyone who requires dialysis. However, there are waiting lists for permanent vascular access placement. Many patients prepare for dialysis as kidney failure approaches and are placed on the access waiting list before beginning dialysis. A recent study on access to dialysis treatment showed that, of 823 patients who were referred for treatment in 1998 and 1999, 710 (86%) were offered dialysis and 676 (82%) accepted treatment (Collins & Metcalf, 2003). The 147 patients who were not offered treatment or chose not to accept it had significantly higher comorbidities, and were older and more disabled than those who commenced treatment. Although the study did not distinguish between the forms of dialysis offered to patients, the authors considered that ‘offer’ rates and ‘acceptance’ rates may be associated with the type and level of service that is available. At the time of data collection, home HD or PD may have been the only form of dialysis available to many patients, which is less true today.

For hemodialysis, the national standard for dose is 1.2 (spKt/V), yet the average that is achieved is 1.4 (spKt/V). Both the standard and the average are similar to doses seen in other countries. The associated range of acceptable HD session length is from 180 to 480 min. The average length is about 270 min, which is longer than that of any other country in the study. Most patients receive thrice-weekly HD, with only 1%–2% receiving more frequent dialysis for clinical reasons. Hemodialysis non-attendance is a large but unquantified problem in some units,

and mainly occurs among patients who have not made dialysis a priority. Anecdotally, this problem is most prevalent in urban populations of lower socioeconomic status.

The technical provision of hemodialysis is standard. All patients use bicarbonate-based (rather than acetate-based) dialysate, and most patients use either synthetic or substituted cellulose hemodialyzers. Reuse of disposable medical equipment is illegal in New Zealand, and this ban extends to hemodialyzers. The technical provision of peritoneal dialysis is notable for the lower proportion of patients on automated peritoneal dialysis than seen in the United States or Europe, a difference largely resulting from efforts to minimize costs.

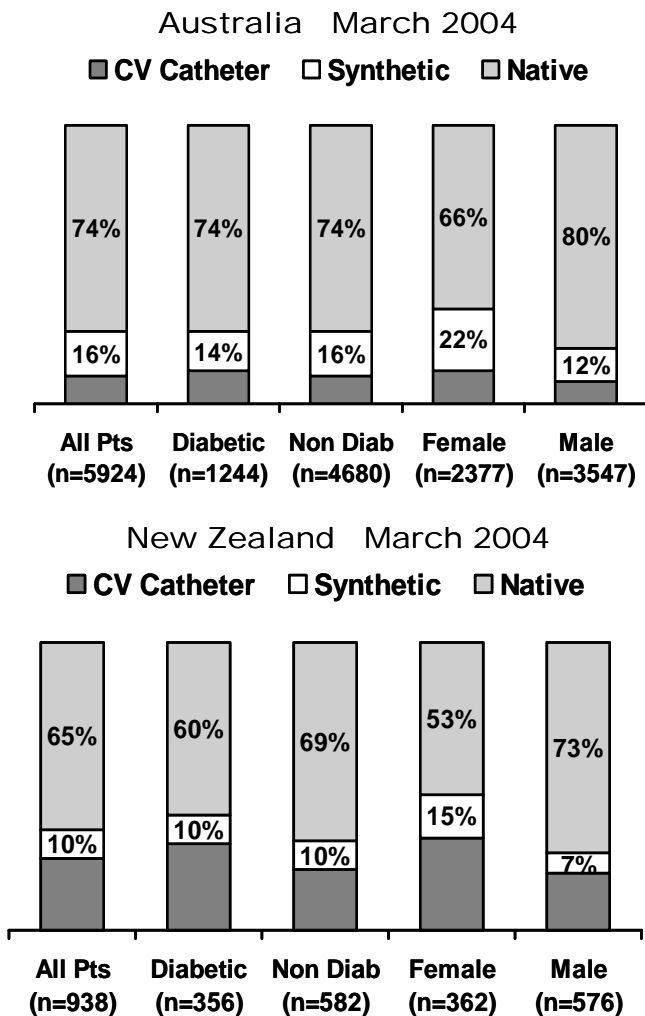
Cost minimization is a central driver to the provision of dialysis services at a DHB level. Because services provided by DHBs are funded by a global budget, dialysis providers must compete for the health dollar within the DHB and abide by overriding organizational priorities set by the board of directors. Projected costs and volumes of diagnosis are considered by both managerial and clinical dialysis service directors, who decide upon service requirements and strategies. Managerial and clinical dialysis service agendas do not necessarily coincide, and the resulting budgetary projections are often a compromise between the competing forces of clinical requirement and resource constraint. The need for cost minimization is therefore widely recognized among clinical staff in the dialysis service, who in most DHBs are extensively involved with the clinical justification within business cases presented by dialysis providers to the DHB for service development.

Despite having fairly similar requirements overall, different DHBs have different financial arrangements for the procurement of dialysis-related goods and services. For instance, Waikato DHB purchases outright hemodialysis machinery, CAPD equipment, and all consumables to provide dialysis on the central North Island of New Zealand. In contrast, Counties-Manukau DHB has a price-per-treatment arrangement with a commercial dialysis company, which is inclusive of the lease and maintenance of hemodialysis machinery, CAPD equipment, and the provision of all consumables. Even when using the same financial arrangements, the overall cost of providing dialysis for a given number of patients varies by as much as 28% between DHBs, mainly as a result of the volumes involved and also the degree of competition between commercial dialysis companies involved in the particular negotiation.

The increasing focus on cost minimization has raised concerns about the clinical quality and safety of dialysis services. There has been worry at both the Ministry of Health and among nephrologists that DHBs are not regulated in a way that would protect patients and staff from the development of substandard dialysis programs, such as those with unsafe facilities or those with inadequate or unskilled staffing. This awareness has been heightened by a series of recent incidents attributable to unrecognized unsafe practice patterns within dialysis programs: In one case, many patients were exposed to chlorinated water in a unit where no water quality checks had taken place for years. As a result, a national multidisciplinary committee is currently working with the Ministry of Health to develop national standards for dialysis service providers as well as an accompanying audit process covering all aspects of service delivery, including facility environs, technical elements of dialysis itself, and dialysis staffing levels and credentialing.

One of the crises in New Zealand hemodialysis practice is the issue of vascular access. It is well recognized that the access of choice is a native fistula, and this is associated with the lowest mortality of all of the available options for vascular access which include prosthetic arteriovenous bridge grafts and central venous catheters (Polkinghorne et al., 2004a). In general, New Zealand has a lower prevalence of fistulae and a higher prevalence of catheters than Australia (ANZDATA) (Fig. 3). However, there is substantial variability in the prevalence of these different accesses between different centers in New Zealand, even when accounting for different patient comorbidity and demographics (Polkinghorne et al., 2004b). The reason for these different practice patterns between centers is unclear. One outlying center with 64% central venous catheters has been without a permanent nephrologist for the majority of the last 5 years, and it is very plausible that this has adversely affected the generation of referrals for vascular access and the coordination of care. Recent studies have highlighted the importance of physician

Figure 3. Type of access for hemodialysis by country, 2004.



Source: ANZDATA Annual Report 2004, p. 50.

and nursing attitudes on vascular access, and also highlighted the effect of surgical skill and operating rates on the success of the procedures. While all of these factors are likely to contribute to the current situation, the dominant factor is likely to be the lack of surgical operating time dedicated to vascular access for HD. The resources needed for this surgery are allocated according to the clinical priorities of the vascular surgery services within DHBs, which often do not recognize HD vascular access as being clinically urgent or important. Even if the other factors mentioned above improve, it is very likely that vascular access in New Zealand will remain suboptimal until separate funding streams for this surgery at a DHB level allow dedicated and appropriate allocation of surgical resources.

Trends and outcomes

Death rates for dialysis and transplant patients in New Zealand have remained fairly constant in recent years (Table 1). Reported death rates are effectively reduced by the selection process, which excludes patients with significant comorbidities from both the dialysis and transplant services. Mortality rates for Māori patients are higher than for non-indigenous patients in New Zealand and Australia, even when adjusted for comorbidities (McDonald & Russ, 2003).

Table 1. Number of deaths and mortality rates, by treatment modality 1998 - 2004

Year	Number of Deaths		
	PD	HD	Tx
1998	105	73	25
1999	98	93	23
2000	139	106	26
2001	135	127	25
2002	123	109	31
2003	131	132	26
2004	38	36	3

Year	Mortality Rate per 100 Patient Years (95% CI)		
	PD	HD	Tx
1998	17.4 (14.3-21.1)	15.6 (12.4-19.7)	2.8 (1.9-4.2)
1999	15.3 (12.6-18.7)	17.8 (14.5-21.8)	2.4 (1.6-3.7)
2000	20.6 (17.4-24.3)	17.3 (14.3-20.9)	2.6 (1.8-3.9)
2001	19.3 (16.3-22.9)	17.8 (14.9-21.2)	2.4 (1.7-3.6)
2002	16.4 (13.7-19.6)	13.8 (11.4-16.6)	2.9 (2.0-4.1)
2003	16.9 (14.2-20.2)	14.9 (12.6-17.7)	2.3 (2.6-3.4)
2004	19.8 (14.4-27.2)	15.5 (11.1-21.4)	1.0 (0.3 -3.2)

PD=Peritoneal Dialysis, HD=Hemodialysis, TX=Transplant.

Source: Australia and New Zealand Dialysis and Transplant Registry.

Although the public health system provides universal access to treatment, it is possible that some of the differences in outcomes may be attributable to differences in treatment. As noted above, the supply of dialysis services differs across regions, and supply is poor in some of those regions where a high proportion of the population is Māori. Services are also likely to be less culturally appropriate for minority ethnic groups. For example, anecdotal evidence suggests that the requirement for regular performance of dialysis may clash with the cultural preferences of Māori and Pacific Islanders (McDonald & Russ, 2003). In a study by McDonald & Russ (2003) examining mortality data for 1997–2002, variables found to be associated with reduced mortality included HD at a frequency of at least three times weekly, and duration of dialysis between 4.5 and 4.9 h. Considerable attention is now being paid to making all health services more responsive to the preferences of minority ethnic groups, especially Māori.

New Zealand is unusual in terms of its high reliance on private out-of-pocket payments for primary health services. While some private insurance plans cover these copayments as well as any payments for outpatient drugs, most New Zealanders do not hold private insurance and there is evidence that the copayments deter some people — especially those with lower incomes — from accessing GP services or picking up a prescription drug (Schoen et al., 2004). Copayments may therefore be a barrier to early detection and treatment of ESRD (although this problem should decline in the future as copayments for general practice consultations decrease). Patients referred late are less likely to be put on the transplant waiting list, and hence less likely to receive a transplant (Cass, Cunningham, Snelling, & Ayanian, 2003). Late referral is also associated with higher morbidity and worse long-term survival rates.

Late referral may also be a factor in the poorer health outcomes of Māori and Pacific Island people. A national survey undertaken in 2002–2003 showed that Māori males (but not females) were significantly less likely to visit a general practitioner than other New Zealanders in spite of their poorer health status (Ministry of Health, 2004b). Māori and Pacific Islanders were also more likely to report an unmet need to see a GP in the past 12 months. However, with the exception of Māori females, this difference was not statistically significant from the rate of unmet need reported by other New Zealanders.

As noted above, the problem of high copayments is now being actively addressed by the government in the form of higher subsidies for primary health services, slated to be rolled out over the next four years (Ministry of Health, 2004b). These higher government subsidies are initially being targeted towards Primary Health Organizations with higher proportions of enrollees who are Māori, Pacific Islander, or live in deprived areas. Subsidies have also recently been increased for all young people under the age of 18 and older people aged 65 years or above. In addition, a program called Care Plus provides extra funding for people with chronic conditions such as diabetes. This funding allows primary health providers to provide high-risk patients with intensive clinical management for free or at a significantly reduced cost. In spite of these increases in funding, higher subsidies will not be available to the entire population until about 2007. Moreover, as long as GPs retain the right to extra-bill, there is no guarantee that higher government subsidies will be passed on to patients in the form of reduced copayments.

Two demographic trends of major significance for the planning of future ESRD services are the aging of the population and the changing ethnic mix. While only 12% of the New Zealand

population is currently aged 65 years or over, there is already a disproportionate increase in the number of new patients in this age group being accepted for treatment of ESRD (Roake, 2004). Other factors contributing to this increase include the explicit removal of age as a criterion for restriction of access to any medical services (discrimination on the basis of age being in contravention of the Human Rights Act of 1993), and older patients' improved quality of life and consequently greater ability to benefit from treatment. As the age of patients increases, issues that will need to be addressed include the practicalities of treating older patients who may be less mobile and require greater personal support, the social and ethical implications of increasing access for older people to limited resources (especially donor organs), and the higher cost of providing services to elderly patients (Roake, 2004).

The median ages of the Māori and Pacific Island populations are more than 12 years below that of other New Zealanders, and these two ethnic groups are growing quite rapidly. The prevalence of obesity and diabetes is high among these groups. Although many service providers have established a range of diabetes prevention programs specifically designed for Māori and Pacific Island people, the incidence of diabetes is still predicted to rise by about two-thirds over the next decade. This change will increase the pressure on treatment services for ESRD, and careful planning is required if universal access to these services is to be maintained.

Conclusion

The method of funding and organizing treatments for ESRD in New Zealand contrasts sharply with that seen in the United States. Public funding, when combined with global budgets and salaried physicians and surgeons, means that medical staff are not generally subject to direct financial incentives that are likely to significantly affect the choice of treatments. However, the total expenditure on health services in New Zealand is relatively low, and global hospital budgets place limits on public funds. These financial constraints have encouraged both physicians and patients to consider the ability of patients to benefit from dialysis, and the impact of dialysis on the quality of the patient's life, before treatment commences. This process of consideration sometimes results in patients being declined treatment or refusing it when offered. The supply of services is also limited in some regions. In part this may be attributed to the smallness and diversity of the New Zealand population, but it also reflects the limited resources in a tax-funded health system.

At present, the private sector neither funds nor provides dialysis or transplant services, with all New Zealand residents being treated in the public health system. It may be that, if funding constraints in the public health system continue, private insurers may introduce dialysis and kidney transplants into their benefit packages, and New Zealanders may increasingly look to the private sector for these services. For the moment, however, dependence upon the public health system for essential treatments remains deeply embedded in the expectations of New Zealanders.

Acknowledgments

We would like to acknowledge Stephen Munn, Ian Dittmer, and Debbie Keys for their useful comments on an earlier draft. The International Study of Health Care Organization and Financing is supported by the Arbor Research Collaborative for Health. The Dialysis Outcomes and Practice Patterns Study is supported by research grants from Amgen and Kirin without restrictions on publications.

Appendix A: Estimating the expenditure per ESRD patient in New Zealand

Dialysis

Costs for routine dialysis, hospitalizations, and outpatient, nondialysis services are from the Auckland Regional Renal Report (unpublished). These are based on 2002–2004 patient data from one major hospital only. However, more recent (unpublished and confidential) work indicates that the costs in the largest hospital providing ESRD services in New Zealand are similar. These estimates comprise all costs, including any incurred by the hospital in transporting patients.

Separate costs for Automated Peritoneal Dialysis (APD) are not available. Using the relationship between various modality costs from Victoria, Australia (Cass et al., 2006) to estimate those in New Zealand, we assumed that APD costs 65% of hospital dialysis. Hospitalization and outpatient costs for APD are assumed to be the same as for CAPD.

Table A1. Estimated costs (NZ\$) for ESRD modalities in New Zealand, 2002-04

Modality	Weight	Cost per patient per year (NZ\$)				Total	Weighted total
		Routine dialysis	Hospital	Non-dialysis services			
<i>Hosp. HD</i>	0.25	42,592	19,150	2,576	64,318	16,080	
<i>Home HD</i>	0.14	20,669	9,601	3,314	33,584	4,702	
<i>Satel. HD</i>	0.16	31,842	13,962	2,368	48,172	7,708	
<i>CAPD</i>	0.36	18,614	15,292	2,709	36,615	13,181	
<i>APD</i>	0.09	27,685	15,292	2,709	45,686	4,112	
Total dialysis						45,782	
<i>Year of transplant</i>	0.10	90,860				8,650	
<i>First full year with transplant</i>	0.10	11,973				1,201	
<i>Other years with transplant</i>	0.90	8,702				7,000	
Total transplant						16,851	
TOTAL ESRD						34,123	

Transplantation

Each renal transplant operation costs an estimated average of NZ\$44,143 (US\$30,235; PPP 2003) (Auckland Regional Renal Report, unpublished data). In the year a person receives a transplant, we assume that he or she has received hospital-based dialysis treatments while waiting (assume six months) and then accrues costs as a transplant patient for the remainder of the year. Therefore, for the first six months of the year, each transplant patient costs NZ\$32,159 (64,318/2). Once the transplant has been received, the patient will cost NZ\$21,838 for the next full year (Auckland Regional Renal Report); however, these costs are not amassed at a constant rate. The first few months after transplantation are the most expensive, and then costs diminish substantially, provided the transplantation was successful (Laupacis et al., 1996). We assumed that two-thirds of the annual cost for the first year after transplantation, or NZ\$14,558, occurred in the six months after transplantation. In sum, the total cost of a patient in the year of transplantation would be NZ\$90,860 (US\$32,233; PPP 2003).

Costs for transplant patients diminish for the first two years after transplantation. The second year after transplantation costs NZ\$9,052 (US\$6,200; PPP 2003), but in all subsequent years, a stable, functioning transplant patient costs NZ\$8,702 (US\$5,960; PPP 2003). Continuing the methodology outlined above to determine a transplant patient's costs during the first full year, the remaining one-third of the first full year's cost (NZ\$7,272) is added to half a year for a stable transplant patient (NZ\$4,351), and the difference between the costs of the second and third years (NZ\$350). Therefore, the total for a transplant patient's first full year is NZ\$11,973 (US\$8,200; PPP 2003). For each year after that, the annual cost is NZ\$8,702 (US\$5,960; PPP 2003).

Weighting the transplant costs by the percentage of patients who are in the year of transplantation, the first full year with a transplant, and all subsequent years, we obtain a total transplant expenditure of NZ\$16,851 (US\$11,542; PPP 2003).

ESRD

In 2003, 59.7% of ESRD patients in New Zealand received dialysis and 40.3% of them had a functioning renal transplant (ANZDATA, 2004). Using these percentages as weights, we estimated that the total annual expenditure per ESRD patient in New Zealand was NZ\$34,123 (US\$23,372; PPP 2003).

References

ANZDATA. (2003). *Australia and New Zealand Dialysis and Transplant Registry 2003*. Adelaide: Australia and New Zealand Dialysis and Transplant Registry.

ANZDATA. (2004). *Australia and New Zealand Dialysis and Transplant Registry 2004*. Adelaide: Australia and New Zealand Dialysis and Transplant Registry.

Barany, P., Carrera, F., Chanard, J., Eckardt, K.U., Hadjicostantinou, V., Leenaerts, P., Leunissen, M.L., Locatelli, F., MacLeod, A., Rutkowski, B., Sanz, D., Schaefer, R.M., Schmieder, R., & Winearls, C.G. (1999).

European best practice guidelines for the management of anaemia in patients with chronic renal failure. *Nephrology Dialysis and Transplantation*, 14, 1–50.

Bremer, B.A., McCauley, C.R., Wrona, R.M., & Johnson, J.P. (1989). Quality of life in end-stage renal disease: a reexamination. *American Journal of Kidney Diseases*, 13, 200–209.

Cass, A., Cunningham, J., Snelling, P., & Ayanian, J.Z. (2003). Late referral to a nephrologist reduces access to renal transplantation. *American Journal of Kidney Diseases*, 42(5), 1043–1049.

Cass, A., Chadban, S., Craig, J., Howard, K., McDonald, S., Salkeld, G., & White, S. (2006). *The economic impact of end-stage kidney disease in Australia*. Sydney: The George Institute for International Health.

Collins, J. (1998). Who should receive dialysis? *New Ethics Journal*, 10(8), 13–19.

Collins J., & Metcalf, P. (2003). Access to dialysis in New Zealand renal services. *New Zealand Medical Journal*, 116 (1175).

Coney, S. (1994). Access to renal dialysis in South Auckland. *Lancet*, 344, 675.

Dor, A., Pauly, M.V., Eichleay, M.A., & Held, P.J. (2007). End-stage renal disease and economic incentives: The International Study of Health Care Organization and Financing (ISHCOF). *International Journal of Health Care Finance and Economics* DOI: 10.1007/s10754-007-9024-9

Health Workforce Advisory Committee (2002). *The New Zealand health workforce: A stocktake of issues and capacity 2001*. Health Workforce Advisory Committee, Wellington.

Jager, K.J., Merkus, M.P., Boeschoten, E.W., Dekker, F.W., Tijssen, J.G., Krediet, R.T., & Necosad Study Group. (2001). What happens to patients starting dialysis in the Netherlands. *Netherlands Journal of Medicine*, 58, 163–173.

Kjellstrand, C. (1996). High-technology medicine and the old: the dialysis example. *Journal of Internal Medicine*, 239(3), 195–210.

Lamping, D.L., Constantinovici, N., Roderock, P., Normand, C., Henderson, L., Harris, S., Brown, E., Gruen, R., & Victor C. (2000). Clinical outcomes, quality of life, and costs in the North Thames Dialysis Study of Elderly People on Dialysis: A prospective cohort study. *Lancet*, 356(9241), 1543–1550.

Laupacis, A., Keown, P., Pus, N., Krueger, H., Ferguson, B., Wong, C.M., & Muirhead, N. (1996). A study of the quality of life and cost-utility of renal transplantation. *Kidney International*, 50, 235–242.

Lynn, K.L., & Buttimore, A.L. (2005). Future of home haemodialysis in Australia and New Zealand. *Nephrology*, 10(3), 231–233.

McDonald, S., & Russ, G.R. (2002). Chapter 2: New Patients. *25th ANZDATA Registry Report*. Adelaide, SA: Australia and New Zealand Dialysis and Transplant Registry.

McDonald, S., & Russ, G.R. (2003). Current incidence, treatment patterns and outcome of end-stage renal disease among indigenous groups in Australia and New Zealand. *Nephrology*, 8, 42–48

Marshall, M. (2003). Predictors of mortality in haemodialysis patients, Chapter 12 in *Australia and New Zealand Dialysis and Transplant Registry (2003) 26th Annual Report*, <http://www.anzdata.org.au/anzdata/AnzdataReport/download.htm>.

Ministry of Health. (a). *Information about the management referral and assessment guidelines*. Retrieved January 5, 2005, at <http://www.electiveservices.govt.nz/guidelineinfo.html>.

Ministry of Health. (b). *Waiting list criteria for renal transplantation*. Retrieved January 5, 2005, at http://www.electiveservices.govt.nz/renal_transplantation.html.

Ministry of Health. (2002). *Diabetes in New Zealand: Models and forecasts 1996–2011*. Ministry of Health: Wellington, NZ.

Ministry of Health. (2003). *Population-based funding formula*. Retrieved April 4, 2007, at <http://www.moh.govt.nz/moh.nsf/49b6bf07a4b7346dcc256fb300005a51/9ec525446f3acc8ccc256e9000125381?Open-Document>

Ministry of Health. (2004a). Memorandum to cabinet: Primary health care strategy: Achieving low cost access proposal. Retrieved January 5, 2005, at [http://www.moh.govt.nz/moh.nsf/0/EC272299ECCBF6E1CC256C4F00028D15/\\$File/CabinetPaperLowCostAccess.pdf](http://www.moh.govt.nz/moh.nsf/0/EC272299ECCBF6E1CC256C4F00028D15/$File/CabinetPaperLowCostAccess.pdf).

Ministry of Health. (2004b). *A picture of health: Key results of the 2003/2003 New Zealand Health Survey*. Ministry of Health: Wellington, NZ.

Ministry of Health. (2005). *Health expenditure trends in New Zealand 1990 - 2003*. Ministry of Health: Wellington, NZ. Retrieved April 12, 2007, at <http://www.moh.govt.nz/moh.nsf/pagesmh/4405?Open>

Mowatt, G., Vale, L., & Macleod, A. (2004). Systematic review of the effectiveness of home versus hospital or satellite unit hemodialysis for people with end-stage renal failure. *International Journal of Technology Assessment in Health Care* 20, 258–268.

National Kidney Foundation. (2001). K/DOQI clinical practice guidelines for anemia of chronic kidney disease, 2000. *American Journal of Kidney Diseases*, 37, S182-S238.

New Zealand Court of Appeal. (1997). Between J Shortland, Appellant and Northland Health Limited, Respondent. October/November 1997.

New Zealand Immigration Service. (2003). Areas of absolute skill shortage. Retrieved April 4, 2007, at <http://glossary.immigration.govt.nz/Areaofabsoluteskillsshortage.htm>.

Oberley, E., & Schattell, D. (1996). Home hemodialysis: Survival, quality of life, and rehabilitation. *Advances in Renal Replacement Therapy*, 3, 147–153.

OECD. (2006). *Purchasing Power Parities (PPPs) for OECD countries 1980–2005*. Paris: Organization for Economic Cooperation and Development. Retrieved February, 2007, at http://www.oecd.org/statisticsdata/0,2643,en_2649_34357_1_119656_1_1_1,00.html

Organ Donation New Zealand. (2005). Organ donation: Facts and figures. Retrieved January 5, 2005 at http://www.donor.co.nz/facts_figures_f_b.html.

Pharmac. (2004). Annual Review 2004. Retrieved January 5, 2005 at <http://www.pharmac.govt.nz/pdf/ARev04.pdf>.

Polkinghorne, K.R., McDonald, S.P., Marshall, M.R., Atkins, R.C., & Kerr, P.G. (2004a). Vascular access practice patterns in the New Zealand haemodialysis population. *American Journal of Kidney Diseases*, 43, 696–704.

Polkinghorne, K.R., McDonald, S.P., Atkins, R.C., & Kerr, P.G. (2004b). Vascular access and all-cause mortality: a propensity score analysis. *Journal of the American Society of Nephrology*, 15(2), 477–86.

Roake, J. (2002). Gifts of life in short supply. *New Zealand Medical Journal*, 115(1159).

Roake, J. (2004). Dialysis in the elderly. *New Zealand Medical Journal*, 117(1195).

Rubin, J., Case, G., & Bower, J. (1990). Comparison of rehabilitation in patients undergoing home hemodialysis: Continuous ambulatory or cyclic peritoneal dialysis vs home hemodialysis. *Archives of Internal Medicine*, *150*, 1429–1431.

Saner, E., Nitsch, D., Descoedres, C., Frey, F.J., & Uehlinger, D.E. (2005). Outcome of home haemodialysis patients: a case-cohort study. *Nephrology Dialysis and Transplantation*, *20*, 604–610.

Schoen, C., Osborn, R., Huynh, P.T., Doty, M., Davis, K., Zapert, K., & Peugh, J. (2004). Primary care and health system performance: adults' experiences in five countries. *Health Affairs*, Web Exclusive. Retrieved April 4, 2007 at <http://content.healthaffairs.org/cgi/content/abstract/hlthaff.w4.487>.

Stewart, J.H., McCredie, M.R., & McDonald, S.P. (2004). The incidence of treated end-stage renal disease in New Zealand Māori and Pacific Island people and Indigenous Australians. *Nephrology Dialysis Transplantation*, *19*(3), 678–685

UK Renal Registry (2003). *Sixth Annual UK Renal Registry Report 2003*. UK Renal Registry, Bristol, UK.

USRDS (2002, 2003, and 2004). *Annual data report: Atlas of end-stage renal disease in the United States*. Bethesda, MD: National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases.

Vonesh, E.F., & Moran, J. (1999). Mortality in end-stage renal disease: A reassessment of differences between patients treated with hemodialysis and peritoneal dialysis. *Journal of the American Society of Nephrology*, *10*, 354–365.

Wood, J.D., Port, F.K., Stannard, D., Blagg, C.R., & Held, P.J. (1996). Comparison of mortality with home hemodialysis and center hemodialysis: A national study. *Kidney International*, *49*, 1464–1470.